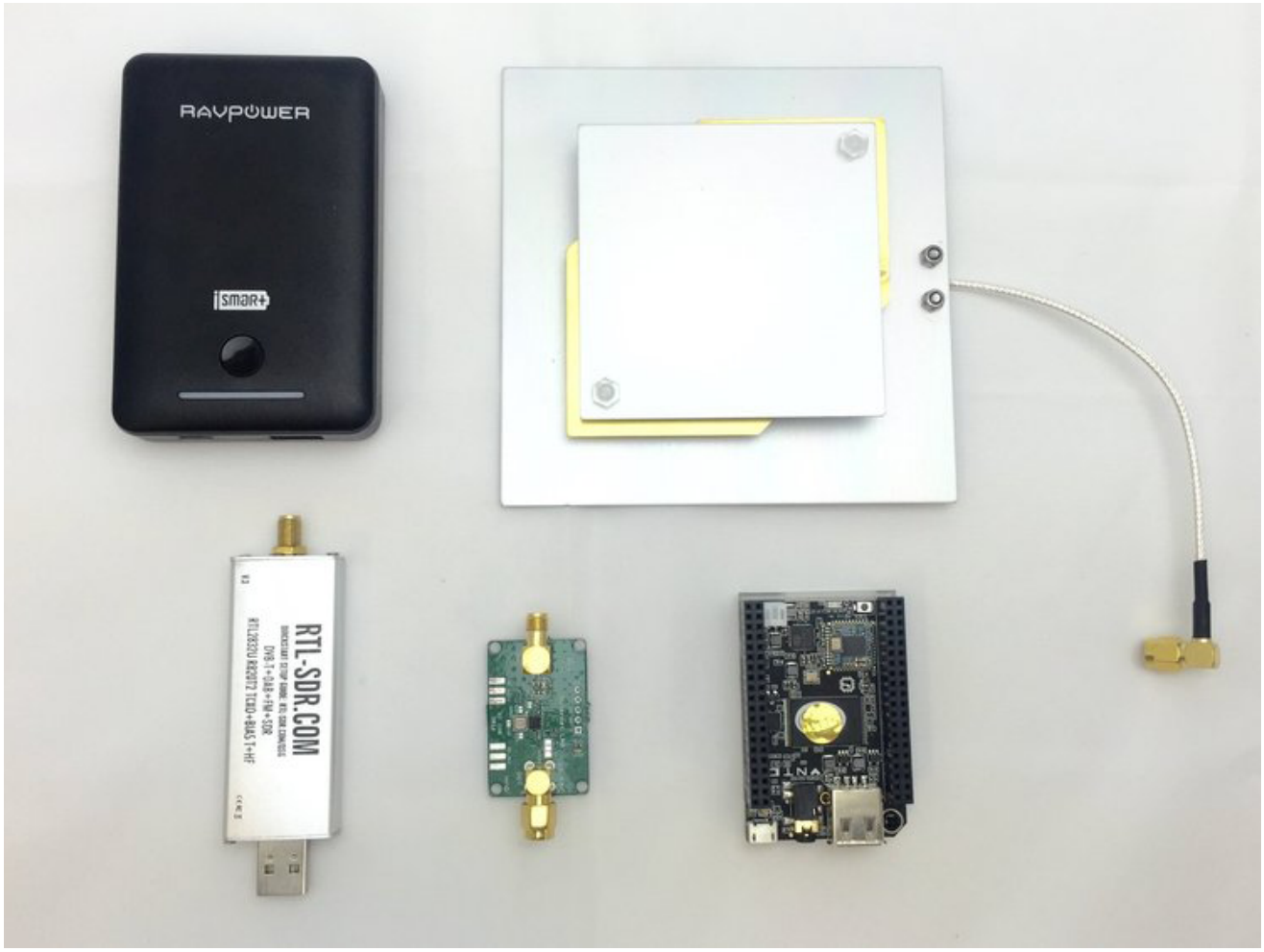


Outernet offers a Do-it-yourself L-Band receiver kit for users at any technical knowledge level, from the plug-and-play users to do-it-yourselfers. Deluxe Kit: $79 - $99 (+ shipping) Antenna, LNA, and SDR Radio, and a C.H.I.P. single board computer and optional battery for mobile power source. (Courtesy: Outernet)

Outernet Update: Free, One-Way Internet Now Via L-Band Satellite

By Kenneth Barbi

Outernet is an L-band satellite service aiming to be a "library in the sky" for all of the places in the world untouched by traditional wired Internet. Its signal, broadcast from multiple satellites, can be received from almost anywhere in the world. Outernet is currently continuously transmitting data consisting of daily Really Simple Syndication (RSS) news feeds in English, Hindi, Chinese, and Arabic.

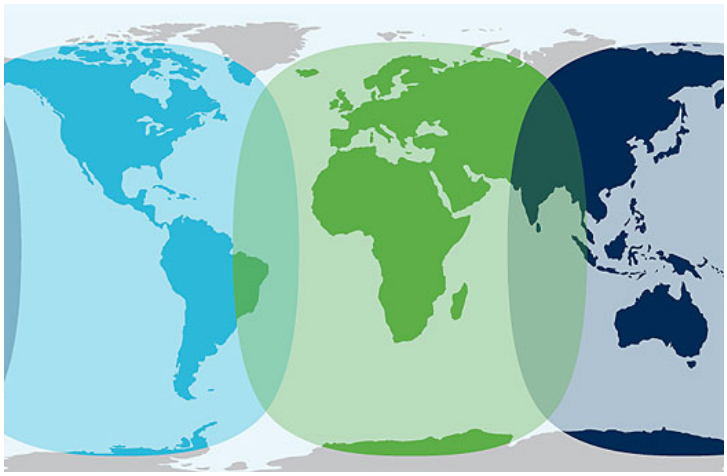
The feeds come from Voice of America (VOA), British Broadcasting Corporation (BBC), Al Jazeera, Deutsche Welle, EurekAlert!, MEDLINE, and the World Health Organization. In addition, there are worldwide weather updates from NOAA; Automatic Packet Reporting System (APRS) messages; books; images; and other data files. The service is free and can be received with a Software Defined Radio (SDR) such as the RTL-SDR, a low noise amplifier (LNA), and a 1.5 GHz antenna.

Their target audience is the people of the world not receiving Internet service. A detailed explanation of the service can be found on Outernet's web site at: **https://outernet.is/docs**

At the beginning of September 2016, Outernet terminated broadcast of its 1 GB/day preliminary data streams on commercial Ku-band satellites. They have refocused their efforts toward their flagship product—the portable L-band 20 MB/day Lantern receiver. Outernet's original Ku-band activities were detailed in my article appearing in the September 2015 issue of *The Spectrum Monitor*.

The new Lantern is very different in appearance from previous designs of Outernet L-band devices. The prototype Lantern has been made available to some project participants. But, you can buy components from Outernet's Chicago store at **https://outernet.is/products** from $79 plus shipping. Or you can order a complete Lantern receiver when they become available.

The changes in design and software are based on what Outernet learned from their Ku-band experience during the last two years.



Global coverage is made possible by using three L-band satellite-sa. From left: I-4 F3 Americas, at 98.4 degrees west (light blue); I-4 FA F4 Alphasat, at 25 degrees east (green); I-4 F3 Americas, at 98.4 degrees west (dark blue). If you are within any of these footprints, you can receive Outernet satellite signals). (Graphic courtesy of Outernet)

One of the most important lessons learned was why Ku-band wasn't working for the global community at large. Simply put, setting up a Ku-band system was a daunting task for many users in remote areas of the world. Mounting and pointing an 80-cm satellite dish was difficult. In several African installations, satellite technicians had to be deployed to do the job. With the L-band Lantern, everything you need is in one box, and pointing just requires a simple compass. Then just add power!

Another issue involved non-uniform reception patterns as Ku-band transponders often have tailored coverage beams. And, in some countries of the world, the very presence of an 80-cm satellite dish is an open invitation for immediate government shut down and operator imprisonment.

The Alpha Lantern has an internal 5300 mAh Lithium Ion battery and an external port for micro USB charging. It has an antenna beam width of 40 degrees and can be operated either stationary or on a moving platform such as a car or boat, which I have recently demonstrated in the Adriatic Sea off the Croatian coast.

Inside the box, a small CHIP computer handles all the processing. This unit operates on a global basis on L- band frequencies with signals broadcast over three of INMARSAT's eleven satellites. Reception is available on all continents and the open seas. The bitrate is 2 kbps, or 20 MB of content per day.

The three satellites are:
I-4 F1 APAC (Asia-Pacific), at 143.5 degrees east - - Frequency of: 1545.9525 MHz
I-4 FA F4 Alphasat, at 25 degrees east - - Frequency of: 1545.525 MHz
I-4 F3 Americas, at 98.4 degrees west - - Frequency of: 1539.8725 MHz

Outernet Lantern disassembled: L-band antenna is at upper left, power cord is at right. (Courtesy: Kenneth Barbi)

Alpha Lantern Components

When the Alpha Lantern is disassembled, you can see all the components neatly mounted under the cover.

Antenna

Outernet uses a small directional L-band patch antenna. The wide 40-degree beam width makes pointing easy—simply aim the Lantern in the general direction of the satellite. The antenna specifications are: 1525 -1559 MHz, 8 dbi, SMA Male connector, and 12cm x 12cm x 1.5cm, 3.5 oz.

Amplifier and Software Defined Radio

Amplifier Specifications: Frequency: 1525-1559 MHz, Center Frequency: 1542 MHz, Gain: 34 dB, Voltage: 3.0V - 5.5 V, Current Draw: 25 mA, Dimensions: 6.5 x 1.5 x 2.5 cm.

SDR Specifications: Ultra-low phase noise 0.5 ppm temp controlled crystal oscillator (TCXO), RF-suitable voltage regulator, custom heat sink; SMA female connector; SDR frequency range of approximately 25 -1700 MHz; Bias-T enabled, brushed aluminum body, 8.5 x 1.3 x 1.7 cm.

Alpha Lantern Power

The Boston Power Swing 5300 Lithium Ion Battery, supplied with the Alpha Lantern, has a capacity of 5300 mAh. It is capable of fast charging and has superior safety features. The Lantern has an external micro-USB charging port requiring a 2 A, 5-volt DC USB power supply to keep the battery charged, and to run the Lantern.

CHIP Computer

Finally, all this equipment connects to an inexpensive CHIP Linux-based computer (using an IC from Allwinner), which runs the display program called Skylark. The com-

puter also generates an internal Wi-Fi hotspot that can be received on any Wi-Fi capable device (computer, smartphone, tablet, etc.), or allow the Lantern to connect directly to your own Wi-Fi network.

Skylark

Skylark is the graphic user interface (GUI) display from which you access Outernet content. Using your computer, laptop, SMART phone or tablet connected to the Wi-Fi network over which Outernet is running, you simply open your favorite web browser, and go to my.outernet.is to find and connect to your Lantern's Skylark 1.2 interface.

Alternate Approache: Outernet in a Box

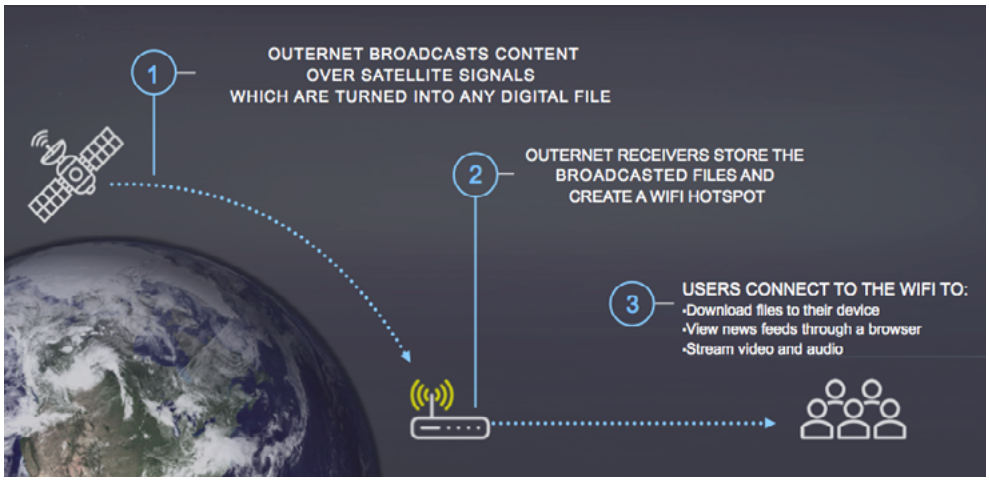
You don't need to use Outernet's hardware to receive their signals. There is another alternative—Outernet In A Box, which can run on a Windows 10, Linux, Macintosh or Solaris host. It uses Oracle's Virtual Box Version 5.1 found at **https://outernet.is/products**. With this approach, all you need is an SDR, LNA, and an antenna. Free software and instructions are available from Outernet at: **https://archive.outernet.is/images/OuternetInABox/Release_2**

After you install the Virtual Box software, you unzip the Outernet software and run it. It automatically sets itself up in your Virtual Box Linux emulation and runs. You won't get the fully visual product as with Skylark—just the downloaded files.

Outernet Broadcast Content

Outernet broadcasts face various copyright and permission issues related to the articles they transmit. Possession of a digital file, regardless of how it was obtained, does not give one the right to share and distribute it. Every work has a copyright holder who has the right to dictate how their work can be used and shared.

Unless you personally created the content you plan to upload to Outernet, you must make sure the content is openly licensed for sharing. This includes



Lifecycle of a file. (Courtesy: Outernet)

works that are in the Public Domain or have share-alike licenses, such as Creative Commons. Examples of permitted content include:

1) Public Domain works either that never qualified for intellectual property rights, or their copyright has expired (for example, a Mark Twain novel). Documents, reports, and Voice of America news articles created by the United States Government are excluded from copyright law and are considered to be in the public domain. Al Jazeera and Deutsche Welle have given Outernet permission to broadcast their RSS news feeds.

2) Creative Commons (**https://creativecommons.org**) offers licenses that allow creators and authors to communicate what rights they reserve and which rights they waive, enabling distribution of a copyrighted work.

At this time, anyone can send files (limited to 10 kB) to Outernet through Outernet's Filecast System at **https://outernet.is/filecast-center**, however, the files must conform to the above rules.

Conclusions

If you want to follow what is going on with Outernet's development, go to **https://discuss.outernet.is**, where many radio amateurs, Free-to-Air (FTA) satellite enthusiasts, and DXers are available to answer your questions. From the outset, Outernet has focused its efforts on providing information content for the part of the world under served by modern communication transmission facilities. Outernet has much to offer and is exciting to follow. I suggest you start your experiment with the CHIP computer, or the Outernet in a Box.

About the Author:

Kenneth Barbi is a retired Electrical Engineer with a degree from CCNY in NYC. He retired from the US Air Force after a 26-year career during which he specialized in HF long haul, microwave, tropo-scatter, and satellite communications. In the late 1980s, while assigned to the White House Communications Agency (WHCA), he implemented the first US government use of commercial Ku-band satellites to support President Reagan. In his final assignment at the Defense Information Systems Agency (DISA), he was the Defense Satellite Communications Systems (DSCS) Manager. He lives in Annapolis, Maryland, and can be reached at ftaenthusiast@verizon.net.